

§ 92.111

40 CFR Ch. I (7–1–04 Edition)

(1) These reference filters shall be placed in the same general area as the sample filters. These reference filters shall be weighed within 4 hours of, but preferably at the same time as, the sample filter weighings.

(2) If the average weight of the reference filters changes between sample filter weighings by ± 5.0 percent (± 7.5 if the filters are weighed in pairs) or more of the target nominal filter loading (the recommended nominal loading is 0.5 milligrams per 1075 square millimeters of stain area), then all sample filters in the process of stabilization shall be discarded and the emissions tests repeated.

(3) If the average weight of the reference filters decreases between sample filter weighings by more than 1.0 percent but less than 5.0 percent of the nominal filter loading then the manufacturer or remanufacturer has the option of either repeating the emissions test or adding the average amount of weight loss to the net weight of the sample.

(4) If the average weight of the reference filters increases between sample filter weighing by more than 1.0 percent but less than 5.0 percent of the nominal filter loading, then the manufacturer or remanufacturer has the option of either repeating the emissions test or accepting the measured sample filter weight values.

(5) If the average weight of the reference filters changes between sample filter weighings by not more than ± 1.0 percent, then the measured sample filter weights shall be used.

(6) The reference filters shall be changed at least once a month, but never between clean and used weighings of a given sample filter. More than one set of reference filters may be used. The reference filters shall be the same size and material as the sample filters.

§ 92.111 Smoke measurement system.

(a) *Schematic drawing.* Figure B111-1 of this section is a schematic drawing of the optical system of the light extinction meter, as follows:

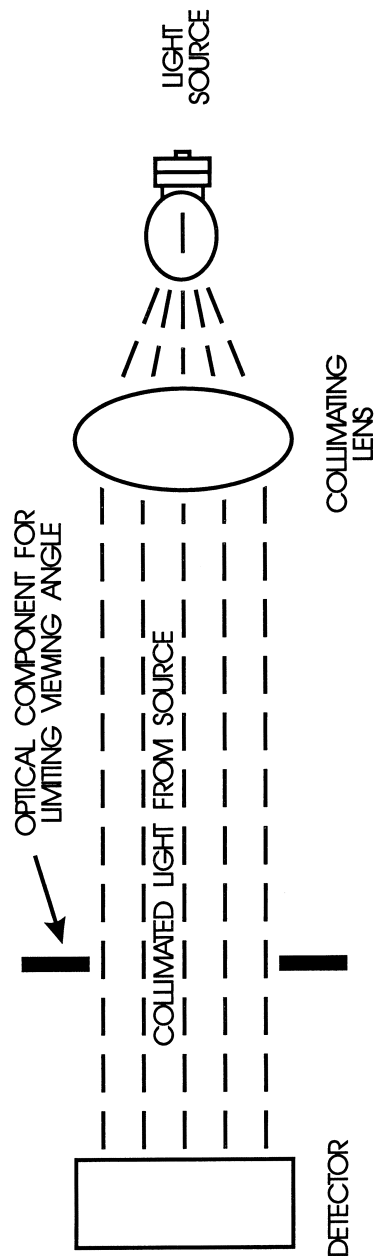


Figure B111-1 SMOKE METER OPTICAL SYSTEM (SCHEMATIC)

(b) *Equipment.* The following equipment shall be used in the system.

(1) *Adapter.* The smoke meter optical unit may be mounted on a fixed or

movable frame. The normal unrestricted shape of the exhaust plume shall not be modified by the adaptor, the meter, or any ventilation system

used to remove the exhaust from the test site. Distortion due to the gaseous or particulate sample probes, or the exhaust duct is allowed subject to the provisions of § 92.114.

(2) *Wind shielding.* Tests shall not be conducted under excessively windy conditions. Winds are excessive if they disturb the size, shape, or location of the exhaust plume in the region where exhaust samples are drawn or where the smoke plume is measured. Tests may be conducted if wind shielding is placed adjacent to the exhaust plume to prevent bending, dispersion, or any other distortion of the exhaust plume as it passes through the optical unit.

(3) *Smokemeter, (light extinction meter).* A continuously recording, full-flow light obscuration meter shall be used.

(i) It is positioned as specified in paragraph (c) of this section, so that a built-in light beam traverses the exhaust smoke plume which issues from the duct. The light beam shall be at right angles to the axis of the plume, and in those cases where the exhaust is not circular at its discharge, the path of the light beam through the plume shall be along the longest axis of the exhaust stack which is not a diagonal of a rectangular exhaust stack.

(ii) The light source shall be an incandescent lamp with a color temperature range of 2800K to 3250K, or a light source with a spectral peak between 550 and 570 nanometers.

(iii) The light output is collimated to a beam with a nominal diameter of 1.125 inches and an angle of divergence within a 6 degree included angle.

(iv) The light detector shall be a photocell or photodiode. If the light source is an incandescent lamp, the detector shall have a spectral response similar to the photopic curve of the human eye (a maximum response in the range of 550 to 570 nanometers, to less than four percent of that maximum response below 430 nanometers and above 680 nanometers).

(v) A collimating tube with apertures equal to the beam diameter is attached to the detector to restrict the viewing angle of the detector to within a 16 degree included angle.

(vi) An amplified signal corresponding to the amount of light

blocked is recorded continuously on a remote recorder.

(vii) An air curtain across the light source and detector window assemblies may be used to minimize deposition of smoke particles on those surfaces provided that it does not measurably affect the opacity of the plume.

(viii) The smokemeter consists of two units; an optical unit and a remote control unit.

(ix) Light extinction meters employing substantially identical measurement principles and producing substantially equivalent results, but which employ other electronic and optical techniques may be used only after having been approved in advance by the Administrator.

(4) *Recorder.* A continuous recorder, with variable chart speed over a minimal range of 1 to 20 cm per minute (or equivalent) and an automatic marker indicating 1-second intervals, continuously records the exhaust gas opacity and throttle position.

(i) The recorder is equipped to indicate each of the throttle notch (test mode) positions.

(ii) The recorder scale for opacity is linear and calibrated to read from 0 to 100 percent opacity full scale.

(iii) The opacity trace has a resolution within one percent opacity.

(iv) The throttle position trace clearly indicates each throttle position.

(5) The recorder used with the smokemeter shall be capable of full-scale deflection in 0.5 second or less. The smokemeter-recorder combination may be damped so that signals with a frequency higher than 10 cycles per second are attenuated. A separate low-pass electronic filter with the following performance characteristics may be installed between the smokemeter and the recorder to achieve the high-frequency attenuation:

(i) Three decibel point: 10 cycles per second.

(ii) Insertion loss: 0 ± 0.5 decibel.

(iii) Selectivity: 12 decibels down at 40 cycles per second minimum.

(iv) Attenuation: 27 decibels down at 40 cycles per second minimum.

(6) Automatic data collection equipment may be used, provided it is capable of collecting data equivalent to or

better than the data required by paragraphs (b)(4) and (5) of this section.

(c)(1) *Assembling equipment for locomotive testing.* The optical unit of the smokemeter shall be mounted radially to the exhaust duct so that the measurement will be made at right angles to the axis of the exhaust plume. The distance from the optical centerline to the exhaust outlet shall be minimized; in all cases it shall be less than 10 feet. The maximum allowable distance of unducted space upstream of the optical centerline is 18 inches. The full flow of the exhaust stream shall be centered between the source and detector apertures (or windows and lenses) and on the axis of the light beam.

(2) *Assembling equipment for engine testing.* The optical unit of the smokemeter shall be mounted radially to the exhaust duct so that the measurement will be made at right angles to the axis of the exhaust plume. The distance from the optical centerline to the exhaust outlet shall be less than 25 feet. The maximum allowable distance of unducted space upstream of the optical centerline is 18 inches. In-line smokemeters are allowed. The full flow of the exhaust stream shall be centered between the source and detector apertures (or windows and lenses) and on the axis of the light beam.

(d) *Power supply.* Power shall be supplied to the control unit of the smokemeter in time to allow at least 15 minutes for stabilization prior to testing.

§ 92.112 Analytical gases.

(a) Gases for the CO and CO₂ analyzers shall be single blends of CO and CO₂, respectively, using zero grade nitrogen as the diluent.

(b) Gases for the hydrocarbon analyzer shall be single blends of propane using zero grade air as the diluent.

(c) Gases for the methane analyzer shall be single blends of methane using air as the diluent.

(d) Gases for the NO_x analyzer shall be single blends of NO named as NO_x with a maximum NO₂ concentration of 5 percent of the nominal value using zero grade nitrogen as the diluent.

(e) Fuel for the HFID (or FID, as applicable) and the methane analyzer shall be a blend of 40±2 percent hydro-

gen with the balance being helium. The mixture shall contain less than 1 ppm equivalent carbon response; 98 to 100 percent hydrogen fuel may be used with advance approval of the Administrator.

(f) *Hydrocarbon analyzer burner air.* The concentration of oxygen must be within 1 mole percent of the oxygen concentration of the burner air used in the latest oxygen interference check (%O₂I). If the difference in oxygen concentration is greater than 1 mole percent, then the oxygen interference must be checked and the analyzer adjusted if necessary, to meet the %O₂I requirements. The burner air must contain less than 2 ppmC hydrocarbon.

(g) The allowable zero gas (air or nitrogen) impurity concentrations shall not exceed 1 ppm equivalent carbon response, 1 ppm carbon monoxide, 0.04 percent (400 ppm) carbon dioxide and 0.1 ppm nitric oxide.

(h)(1) "Zero-grade air" includes artificial "air" consisting of a blend of nitrogen and oxygen with oxygen concentrations between 18 and 21 mole percent.

(2) Calibration gases shall be accurate to within ±1 percent of NIST gas standards, or other gas standards which have been approved by the Administrator.

(3) Span gases shall be accurate to within ±2 percent of NIST gas standards, or other gas standards which have been approved by the Administrator.

(i) Oxygen interference check gases shall contain propane at a concentration greater than 50 percent of range. The concentration value shall be determined to calibration gas tolerances by chromatographic analysis of total hydrocarbons plus impurities or by dynamic blending. Nitrogen shall be the predominant diluent with the balance being oxygen. Oxygen concentration in the diluent shall be between 20 and 22 percent.

(j) The use of precision blending devices (gas dividers) to obtain the required calibration gas concentrations is acceptable, provided that the blended gases are accurate to within ±1.5 percent of NIST gas standards, or other gas standards which have been approved by the Administrator. This accuracy implies that primary gases used